

# NASA TECH BRIEF



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## Remote Control Thermal Actuator

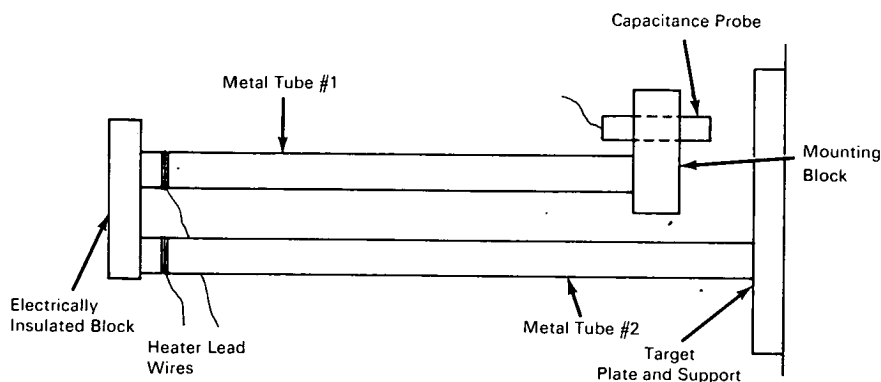


Fig. 1

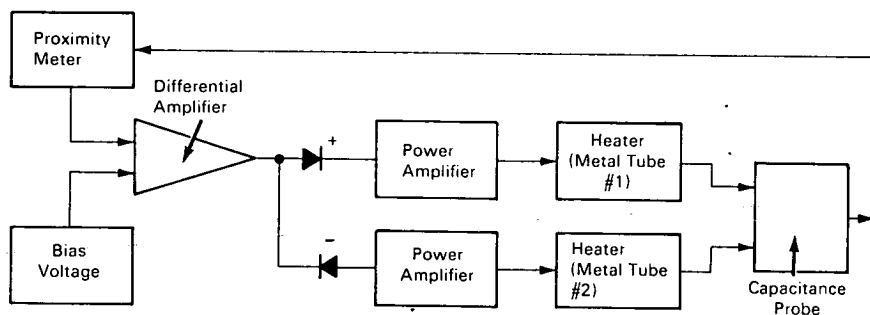


Fig. 2

A thermal actuator has been developed for making small, precise changes of the order of a few micro-inches in the position of an object with respect to a second object. It is particularly useful where severe environmental conditions, such as high temperature, inhibit the use of other types of actuators such as motors, solenoids, or hydraulic cylinders.

The thermal actuator consists primarily of two metal tubes and a capacitance type proximity meter (Figure 1). When the metal tubes are heated elec-

trically, their thermal expansion changes the position of the mounting block. Heating tube number 1 will move the block toward the target plate; heating tube number 2 will move the block away from the target plate. A capacitance probe (the sensing element of the proximity meter) measures the change in position of the block relative to the fixed target plate.

By placing the proximity meter in the feedback loop of a differential amplifier (Figure 2), the mounting block can be remotely positioned. In this system,

(continued overleaf)

the metal tubes act as resistance heaters. Any difference between the proximity meter output voltage and the bias voltage is amplified by one of two amplifiers depending on whether the signal is positive or negative (i.e., whether the position is greater or less than that represented by the bias voltage). The power amplifier in turn supplies a change in current to the appropriate tube, causing the tube length to change and position the mounting block at the desired position. Consequently, the bias voltage remotely controls the block.

#### Notes:

1. A bimetallic strip could be used in place of the tube. Other types of proximity meters could be used and the probe can be attached to the block or target plate. The tubes could be heated directly or indirectly, possibly by a laser beam.

2. This type of actuator was used to calibrate a capacitance probe at a temperature of 1000 degrees F., using a second probe at room temperature as a standard.
3. No further documentation is available. Technical questions may be directed to:

Technology Utilization Officer  
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Cleveland, Ohio 44135  
Reference: B69-10307

#### Patent status:

No patent action is contemplated by NASA.

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